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OBSERVATIONS
AND
EXPERIMENTS
ON THE
POISON OF LEAD;

By THOMAS PERCIVAL, M.D.

Fellow of the ROYAL SOCIETY, and of the SOCIETY
of ANTIQUARIES in LONDON.

Hæc tu Romane caveto!

Sed Romæ quis non?

PERSIUS.

L O N D O N :

PRINTED FOR J. JOHNSON, ST. PAUL'S CHURCH-YARD.

MDCCCLXXIV.

Tr. 2074.

1867, Oct. 19,

Gift of

John Jeffries, M.D.,

and

Benj. Jay Jeffries, M.D.,
of Boston.

(P. C. 1815 & 1854.)

T O

GEORGE BAKER, M.D.

Fellow of the COLLEGE of PHYSICIANS,
and of the ROYAL SOCIETY;

AND PHYSICIAN TO

Her MAJESTY's Household.

DEAR SIR,

YOUR excellent Treatises on the POISON of LEAD, first excited my attention to this interesting

vi DEDICATION.

ing subject; and the approbation with which you have honoured this little work, is my best apology for offering it to the public. To whom then can I with so much propriety inscribe these Observations as to you, of whose judgment I entertain the highest opinion, whose candour I have experienced, and whose

DEDICATION. vii

whose friendship I shall
ever wish to cultivate? Ac-
cept them, therefore, as a
tribute of gratitude and
esteem; and believe me to
be, with the truest respect,

DEAR SIR,

Your faithful, obliged,

and affectionate

humble Servant,

MANCHESTER,
Jan. 1. 1774.

THOMAS PERCIVAL.

Lately published,

IN TWO VOLUMES OCTAVO,

Price NINE SHILLINGS sewed,

ESSAYS

MEDICAL AND EXPERIMENTAL;

By THOMAS PERCIVAL, M.D. F.R.S. & S.A

L O N D O N :

Printed for *J. Johnson*, St. Paul's Church-Yard.

MISCELLANEOUS
OBSERVATIONS
AND
EXPERIMENTS
ON THE
POISON OF LEAD.

SECTION I.

THE public has been lately
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which reflect equal honour on the
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SECTION I.

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learning, ingenuity, and benevolence of the author. His observations on its ready admission into, and injurious operation on the human body, are highly interesting and important; and clearly evince that many chronic, as well as acute diseases, proceed from this mineral poison, when such a cause is unsuspected.

NOR is the action of Lead confined to the human species: it exerts alike its deleterious powers on quadrupeds and birds.

A GENTLEMAN in Staffordshire .
used to feed his hounds in troughs
lined

OF LEAD. 3

lined with Lead, and they never hunted but three or four of them fell down during the chace, convulsed and seemingly in agonies of pain. A friend suggested to the owner of the dogs, that these convulsions might possibly arise from some portion of Lead dissolved in their food. The leaden troughs were therefore removed, and the hounds from that time were entirely free from this disorder. Another instance, of a similar kind, was related to me by a country gentleman who resides in Derbyshire.

AN intelligent Plumber in Manchester assures me, that he is unable

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to keep a cat in his house above a month or two. The animal soon sickens, becomes rough in its coat, listless, emaciated, and dies in a short time of a *marasmus*. These symptoms he ascribes to the particles of Lead scattered upon the floor of his work-shop, which adhering to the feet of the cat, and being licked off, are swallowed, and exert their virulent powers immediately on the stomach and bowels. A person of the same business, and of good credit in Sheffield, has observed that cats are fond of the sweet powder with which the surface of Lead is generally covered; and that they are affected by
it

it in the manner just described: but he adds that they are sometimes driven to the most outrageous madness; and that he has cured many of these animals, when labouring under the most frightful symptoms, by pouring sweet oil into them.

AN ingenious Apothecary, whose house is contiguous to a Plumber's shop, has more than once observed appearances of the *colica pistonum* in his cats; and some of them have become quite frantic with pain.

A RED linnet, very lively and in perfect health, and which had been long

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long used to confinement in a cage, was placed in a parlour, recently painted with Lead. The bird soon sickened, continually gasped for breath, and died in a few days. Another bird of the same species, and equally healthy, was then purchased to supply its place. This was presently affected in a similar manner, and died in less than a week.

A LADY who is attentive to the feeding of her poultry, had troughs of Lead made for them, on account of their being more durable and cleanly. After the use of these she
observed

observed that her fowls and chickens became sickly, spiritlefs, and emaciated. The food she gives them consists of bread, potatoes, barley, &c. mixed with butter-milk. The latter ingredient is a powerful solvent of lead; and thus poison is mingled with their nourishment.

A NUMBER of ducks and geese, the property of a painter, were all killed by being confined, a single night, in a place supplied with the water in which his brushes had been steeped, to prevent their becoming dry.

SATUR-

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SATURNINE preparations are now almost universally employed in surgery; and from their astringent, antiseptic, and sedative powers, are justly classed in the first rank of topical remedies. But Mr. Goulard strenuously maintains that the external use of Lead is *never* attended with any of the pernicious effects of its internal exhibition. And we have the concurring testimony of his very ingenious commentator to these facts. (a) The evidence of these gentle-

(a) Vide Mr. Aikin's Observations on Preparations of Lead, page 10.-----My friend Mr. White, who uses large quantities of the Extract of Lead both in his

gentlemen seems to be further corroborated by the experience of the faculty at Chester, on a late melancholy occasion. November 5th, 1772, a large number of people, assembled at a puppet shew, were blown up by the accidental explosion of gunpowder, placed underneath in a grocer's warehouse. The sufferers admitted into the Infirmary were in number fifty-three, not one of whom escaped without violent marks of contusion, or large and deep burns in different parts of the body. They

were

his private, and Hospital practice, entertains the same opinion with Mr. Aikin, of its innocency, and efficacy.

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were all repeatedly washed with Goulard's saturnine water, which in every instance seemed to produce the most salutary effect. And though the circumstances of these unhappy patients appear to have been peculiarly favourable to the absorption, as well as to the immediate action of this mineral poison on the nervous system, no symptoms afterwards occurred, which could reasonably be imputed to its operation. Three of the sufferers indeed died of the locked jaw; but this disease, with sufficient probability, was ascribed to the bruises which they received about the joints. Strong as this evidence
may

may be esteemed of the innocency as well as efficacy of Lead, externally applied, I am still inclined, with Dr. Baker, to believe that it *sometimes* produces its specific effects upon the body; and the following cases, though not decisive, will at least shew that my opinion is not entirely without foundation.

THREE years ago a young man had a tumour of the spine, which had resisted various discutient remedies. An emollient cataplasm, mixed with the *extractum saturni* of Goulard, was applied. In a few hours he was seized with violent pains

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pains in the bowels, and severe cramps in the extremities, which ceased soon after the cataplasm was removed.

A GENTLEWOMAN, in August 1770, was over-turned in a chaise, and thrown on the side of her head and shoulder; the muscles of which were much bruised and strained, but the *humerus* was neither fractured nor dislocated. She was immediately bled, and the venæsection was repeated the next day. A saturnine fomentation was applied warm to the parts affected, and frequently renewed. Twitchings in the legs ensued, and

and afterwards spasms in the stomach. The fomentation was omitted, and these symptoms ceased; nor did any other application produce the like effect. This lady is subject to the colic; but as she was ignorant of the specific action of Lead, the spasms in her stomach cannot be imputed to the force of imagination.

THE governor of the work-house in Manchester, aged upwards of seventy years, had a large ulcer in his leg, which was washed several times in the day with the saturnine water of Goulard, and then covered with an emollient poultice, which contained

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tained a small quantity of the extract of Lead. After using these applications four days, he became affected with the colic, and also with paralytic symptoms, which though slight in degree, could not fail to be alarming. The preparations of Lead were therefore discontinued, a dose of *oleum ricini* was administered, and he soon recovered from these adventitious complaints.

A LADY of a delicate habit, and the mother of four children, soon after delivery, to avoid being a nurse, rubbed her breasts with oil in which litharge and red lead had been boiled.

Her

Her milk was by these means repressed; but in a short time she began to complain of acute pain about the stomach and duodenum, loss of appetite, flatulency, and depression of spirits. Opium and the warm bath were the only remedies that afforded relief. Whether these complaints arose from the recession of the milk, or were occasioned by the poisonous action of the calces of Lead, I leave to the decision of my reader.

IN June 1757, a Physician of great humanity, was desired to visit a woman who had a varicose swelling
of

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of the veins of the right foot, attended with great pain, swelling, and inflammation. He directed a solution of *saccharum saturni* and opium, in elder flower water, to be frequently applied, by means of linen rags, to the part affected. The pain was alleviated, the swelling diminished, and the redness soon disappeared. But in a few days severe vomitings, a violent colic, and obstinate constipation of the bowels supervened; and the woman was ever afterwards subject to frequent returns of these complaints. The saturnine solution was used only four or five days; nor was it then discontinued from any suspicion

suspicion of its injurious effects. For very little attention was at that time paid to the noxious qualities of Lead.

I HAVE been assured from undoubted authority that Dr. A—— had a slight paralytic affection of his legs, by the practice of setting his feet every evening, on a piece of Lead placed near the fire. And that a dog by lying on it, was entirely deprived of the use of his limbs.

ZELLER mentions a remarkable instance of the pernicious effects of
D litharge,

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litharge, which Dr. Baker has quoted.

*“ De Lithargyrio quoque mihi narra-
 “ vit, matronam quandam nobilem
 “ pulverem ejus, in rubore faciei, post-
 “ quam hic ipsi tanquam singulare et
 “ certissimum arcanum deprædicatus fu-
 “ isset, in petia ligatum, axillis bis vel
 “ ter die aspersisse cum presentaneo ef-
 “ fectu; verum exinde subsecuta fuisse
 “ dyspnæam, lipotkymiam, dolores va-
 “ gos in abdomine, vomituritionem, et
 “ nauseam.”* This account the Doc-

tor has confirmed by the case of a violent and obstinate colic, which appeared to be occasioned by some litharge mixed in a cataplasm, and applied to allay a troublesome itching.

ing. (a) The testimony of Boerhaave must also be admitted to have great weight on this subject; and he seems to speak from experience, when he says, after describing the process for making vinegar of Lead, " This preparation if rubbed upon the skin, in a state of dilution, cures eruptions, redness, the erysipelas, and inflammations; gives whiteness and beauty to the skin, but proves injurious to the body, at length occasioning a consumption,

as

(a) Medical Transactions, Vol. I, page 312.

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“as appears by many melancholy
“examples.” (a)

(a) “Si dilutum corpori affricetur, pustulas, ru-
“bedines, erysipelas, phlegmonas multum levat; cuti
“candorem, nitoremque conciliat; sed corpori no-
“cet, tandem in phthisin deducendo, ut tristissimis
“sæpe constitit exemplis.”

Element. Chæmiæ, Vol. II. Proc. 172.

S E C.

SECTION II.

THE following observations concerning the effects of Lead I have collected in Derbyshire. There are many mines of this ore, from the working of which no inconvenience ensues. (a) But the case is otherwise

(a) THE Earl of Hopetoun informs me that his miners are, in general, a very healthy set of men.

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otherwise where the vein of ore is narrow, and the lime-stone sides are very hard; for then the small particles of the ore, which fly off from the tool by the force employed in digging it, fall upon the faces of the work-men, and are frequently received into their mouths. The same is true also of the mines in which the water runs through the ore; for the faces of the men are continually sprinkled with it, by the dashing of the pick-axes, and they look as if rubbed over with gun-powder. To render the ore fit for sale it is broken, and carefully washed from the impurities which adhere to it. If
any

any cattle drink of the water which has been used for this purpose, they are affected with violent colics, and constipation of the belly; and they generally die convulsed. Dogs and cats, from the same cause, will sometimes become mad, fall into fits, and often kill themselves by running headlong against a wall.

THE *colica pistorum* is more incident to those employed in the smelting of Lead, than to the workers in the mines. But since cupolas have been used for that operation, it has prevailed much less than formerly, even amongst this class of men. For
the

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the vapours arising from the Lead are thus carried off, by a strong current of air, through a chimney, which is raised many yards above the furnace. These vapours destroy the verdure of the grass which grows in the neighbourhood of the smelting houses; and the cattle which feed on it are sometimes affected with the dry gripes, or, as it is vulgarly termed, the belland. But the most frequent cause of this disorder amongst horses and cows, is the grazing in pastures, which have been over-flowed by floods from the mines. And it is remarkable that these animals, who are generally directed to avoid what-
ever

ever is injurious to them, by an instinct wise and unerring in its operation, so far from being averse to this mineral poison, are fond and even greedy of it to excess. The same is true also of pidgeons, and other tame fowls, who pick up the small particles of Lead whenever they meet with them. Sheep are seldom known, in Derbyshire, to be affected with the belland.

I AM indebted to an experienced and judicious practitioner, who resides at Bakewell in Derbyshire, for the following information concerning the usual method of treating the *colica*

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pietorum

plumbum amongst the workers in Lead. The men first complain of a weight, pain of the stomach, and costiveness, which are generally relieved, if they apply early for advice, by a vomit, and pills of soap, rhubarb, and aloes; or by any aperient medicines of the liquid kind, with oil added to them. But if these symptoms be neglected, the patients complain of their saliva becoming sweet, of clammy sweats, lassitude, feebleness of the legs, a total loss of appetite, obstinate costiveness, and a fixed pain in the abdomen, with severe reachings. In this stage of the disorder, oily clysters and gentle purgatives
are

are the most effectual remedies; and are usually repeated at short intervals, till the stools assume a natural appearance. For during the disorder they are hard, dry, and scaly like bran. The *oleum ricini* has of late been used with great success.

I CANNOT omit this opportunity of recommending the trial of alum, both as a prophylactic, and as a remedy in slighter cases of the *colica piotonum*. I have administered it with the happiest effect in various obstinate and painful affections of the bowels. Fifteen grains given every fourth, fifth, or sixth hour, for the most part prove gently aperient; and if the

symptoms be not very severe, the second or third dose seldom fails to mitigate the pain, and sometimes entirely removes it. When there is reason to apprehend that the alum may be too rough or austere in its action, it may be combined with gum arabic, or sperma ceti; and under this form it is most likely to be serviceable in the colic arising from Lead. This medicine when continued for a sufficient length of time, seems to abate flatulence, to obviate spasm, to improve the appetite, and to strengthen the organs of digestion. And on these tonic powers the virtues of alum must chiefly depend; though

though they may in part arise from its obtunding the morbid sensibility of the intestines, by an immediate action on their nerves. To these it is applied more quickly and forcibly, and through a larger extent than most other astringents, from its ready solubility in the stomach, great stypticity, and unchangeable nature. (a)

IN Derbyshire, when the miners or smelters of Lead find themselves affected with the asthma, they usually

(a) Vide Cases of Obstinate Colics cured by the Use of Alum, Percival's Essays Medical and Experimental, Vol. II. page 194.

ally leave their occupation for a while, and work at the lime-kilns, experience having taught them that the fixed air or *mephitis* arising from the calcination of lime-stone, is an effectual and speedy remedy in this disorder. No other change of employment affords them so much relief. The same vapour, in a moderate degree, seems to be salutary to the human constitution; for I have been informed by a gentleman of judgment and veracity, who has the direction of a considerable number of lime-kilns, that the men employed in burning lime are remarkable for their health and longevity. This observation

fervation is the result of more than thirty year's experience; and perhaps may corroborate the popular opinion, that in consumptions of the lungs it is good to live near places where this process is carried on.

It is the common practice of the smelters of Lead, and of others also who live in the neighbourhood of smelting mills, to broil mutton, beef, or pork steaks on the hot pigs of that metal, by which the flesh acquires a peculiarly agreeable flavour. It is probable the flavour depends upon the sweetness communicated by the effluvia of the new-cast lead;
but

but however grateful to the palate, it must be injurious to the nervous system. A Clergyman at Bakewell, who was fond of fishing, and often used to broil his fish in this way, was affected, during several years before his death, with colics, frequent reachings, and a total loss of appetite. His disorder was ascribed to an irregular gout; but the Apothecary who attended him is now of opinion, that it was produced by the dangerous practice above-mentioned; to the consequences of which he was then a stranger.

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THE river Derwent flows through a large tract of Derbyshire, which abounds with Lead mines; and the streams discharged from many of them, and which are loaded with particles of Lead, fall immediately into it. Yet it is stored with Trout and other fish, and the water of it is potable, and not esteemed unwholesome. But I have often remarked, that the Trout caught in the Derwent near Matlock, are of a smaller size, of a softer texture, paler colour, and of a less agreeable flavour than those of other rivers. And I am inclined to impute this to the action of Lead; because the same kind of

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fish

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fish are found in great perfection in the river Trent, into which the Derwent flows, after a passage which allows time for the precipitation of the ore which it contains. The following fact also, if it be deemed sufficiently authentic, confirms my opinion. It is related in a letter from Dr. Carte of Manchester to Dr. Grew, of which I shall insert a copy in the Appendix, that the reader may determine the degree of credit which is due to it. “I know a small
 “rivulet, on which some of these
 “mills stand, wherein Trouts have
 “been caught which have been supposed
 “affected with the bellan, by
 “the

“ the irregularity of their growth,
“ their heads being great and misshapen,
“ their backs crooked, their
“ tails very small, which I am apt
“ to think might proceed from their
“ feeding on the smitham or dust
“ that is washed down at a flood:
“ for not only the fumes, but also
“ the washings of the Lead ore, and
“ the waste (as they call it) i. e. the
“ dust that remains after the ore is
“ melted, is very noxious to most
“ sort of creatures, and for this reason,
“ they that live near the mills
“ dare not water their horses at the
“ river upon a flood.”

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THE Manufacturers of the White and Red Lead Works in Sheffield, are frequently and violently disordered; but they seldom apply to the faculty for assistance, because they have certain popular remedies amongst themselves, which are chiefly of the laxative kind. Some of these workmen, when labouring under complicated affections of the lungs, stomach, and bowels, have been speedily relieved by a dose of emetic tartar, sufficient to operate both as a vomit and purgative. And a blister applied to the abdomen has also been known to remove a very
severe

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severe colic, arising from the same poison.

THE composition called by braziers Pot-metal, because pots for boiling food are made of it, consists of nearly equal parts of copper and lead, with a small proportion of litharge and of antimony. Brass cocks are also made of the same materials. The heat necessary for fusing this composition is much greater than what is usually employed by plumbers, and sufficient to evaporate Lead very copiously; and this evaporation is much increased by the flux which is often employed. The workmen

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in these two articles use few or no precautions excepting chimneys that draw well, but they are unavoidably exposed to the noxious vapours every time they pour the metal into a mold. Yet I have heard from good authority that not above one in forty of these artists becomes considerably diseased, in the manner supposed to arise from Lead; although a few of them are sometimes most violently afflicted with colics and palsies. Indeed there seem to be certain constitutions very little disposed to be affected by this mineral poison, either externally or internally applied. Two cases have been communicated to
me,

me, of the Vinegar of Lead being swallowed in no inconsiderable quantity, without prejudice. It proved in the one instance powerfully diuretic; in the other it produced no sensible effect.

A PHYSICIAN well known to the public by his useful and ingenious writings informs me, that during his residence in the West Indies, many cases fell under his observation which justify the utmost caution in the use of Lead, and of its preparations. In one of the small Virginia Islands near Tortola, a Gentleman who possessed many slaves, built a spacious house,

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which

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which was covered with shingles, that is wood cut into the form of tiles, and painted with red Lead. The rain that fell upon this roof, was conveyed by pipes into an open cistern of Lead for the use of the family; the individuals of which had been peculiarly incident to violent, and sometimes fatal colics. The Physician very justly attributed this disorder to the Lead carried off, by the rain, from the shingles, or corroded by the water in the cistern. And he had afterwards the satisfaction to find, that those who refrained from this water were no longer liable to attacks of the colic.

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A LEARNED friend of mine is of opinion, that the colic from Lead was more common amongst the ancients than is generally suspected. Their drink, he observes, was chiefly wine of the acescent kind, which powerfully corrodes this mineral: and pains of the bowels were very general complaints, as appears from the writings of Celsus. Oil also, both externally and internally, was the remedy prescribed in such cases, the efficacy of which is chiefly, if not entirely confined to the *colica piletum*. (a)

THE

(a) Vide Celsus de Morb. Intest. tenuioris. Aretæus de Ileco, & Cælius Aurelianus,

THE workmen in the Sugar-house at Manchester are supplied with beer, prepared of malt and the refuse of the sugar, which are often fermented together in a large leaden cistern. The liquor ferments so briskly, that without the utmost care it becomes foxed, or inclined to acidity, and the men who drank of it were formerly subject to the most severe and excruciating colics. Of late, proper measures have been taken to check the progress of the fermentation; and the sugar boilers, in consequence of this precaution, have been since exempt from those violent attacks to which they were before incident. Whether these colics

lics were owing to a solution of Lead, or to the acidity of the wort, I shall not presume to determine.

A LADY of a delicate constitution, whose bowels are very irritable, always finds herself affected with the colic if she sits half an hour in a room which has been lately painted. And a Gentleman and his wife, by sleeping in such a chamber a few years ago, were both violently disordered. The Gentleman informs me, that when he first awaked, he felt a great oppression at his breast, a tremor, nausea, and a severe pain and great confusion in his head. By
changing

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changing his apartment, these symptoms were in a short time happily removed.

S E C.

SECTION III.

THE honourable and ingenious Mr. Cavendish has shewn that calcareous earths may be rendered soluble in water, by furnishing them with more than their natural proportion of fixed air. And it has been lately discovered that iron also may be suspended, by this principle, in the same menstruum. I have
con-

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converted Buxton water, which abounds with mephitic air, into a most grateful chalybeate, by shaking a few iron filings in a bottle of it, recently drawn from the well. It appeared therefore not improbable that fixed air might, in a similar manner, have the property of dissolving Lead in water; and that this poisonous mineral might thus gain admission into the human body from fountains unsuspected, and even celebrated for counteracting its pernicious effects. At Bath, the leaden cistern which serves as a reservoir for the spring at its first rise, is said to be very much corroded on the inside,

inside, and to have long furrows visible on every part of it. (a) Pleased with the idea of detecting a new, or at least unknown solvent of Lead, I made the following experiment, which convinced me of the fallacy of my reasoning, and of the caution with which conclusions from analogy should be formed, on philosophical subjects.

EXPERIMENT I.

SOME filings of Lead were briskly agitated in a phial closely corked and

(a) Vide Dr. Falconer's very ingenious and useful Treatise on the Bath Waters.

and filled with water impregnated with fixed air, by a process which Dr. Priestley has lately communicated to the public. A few drops of the volatile tincture of sulphur were added to a wine-glass full of this water, carefully decanted. No blackness or precipitation of Lead ensued, but the water was tinged with the yellow colour of the tincture. The same tincture of sulphur instantly occasioned a dusky hue in another glass-full of spring water, containing one drop of a solution of *saccharum saturni*. This experiment was repeated twice with the same result, and in the second trial the Lead was immersed

merfed in the artificial mineral water forty-eight hours. This experiment feems to afford a decifive proof that fixed air is incapable of diffolving Lead. But the learned writer whose authority is fo often quoted in thefe sheets, has fuggested to me that the volatile tincture of fulphur may perhaps act only on an acid solvent of Lead. The objection is undoubtedly a forcible one; yet I think it may be answered by an experiment which Dr. Baker has himfelf related, by which it appears that even the mechanical mixture of Lead and water has been evinced by the fame test which I employed.

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IT hath long been a prevailing opinion that water, flowing through leaden pipes, acquires certain noxious qualities. Hippocrates and his commentator Galen expressly condemn the use of such water; and Vitruvius in his Treatise on Architecture, remonstrates strongly against that means of conveying it. Neumann, whose authority, as a chemist, is of great weight, gives it as his opinion, that the waters conveyed by pipes may corrode some of the matter of the pipe, or of its cement, and thus contract disagreeable qualities. And he assures us, that having

ing examined the aquæducts at Rome, those between Marly and Versailles in France, and those by which London is supplied with the New River water, he found them in some places liable to this inconvenience. (a) And Dr. Falconer, with great propriety, imputes the failure of cure of many bowel disorders, and the obstinate costiveness so much complained of on drinking the Bath waters, to a very slight solution of Lead which he supposes them to contain from the corrosion of the cistern before-mentioned.

(a) Neumann's Chemistry, by Lewis, page 248.

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mentioned. (a) Baron Van Swieten also relates, "*Vidi integram familiam hoc morbo (scilicet colica pittonum) laborasse, dum ad culinares usus adhibebatur aqua, in magno receptaculo plumbeo collecta, & diu hærens.*" This metal dissolves very readily in weak *aqua fortis*, in the volatile vitriolic acid, or in oil of vitriol well diluted with water. (b) And from Dr. Cullen's Table of Elective Attractions

(a) THE waters of the Hot Bath are observed rather to open, than bind the body. The reservoir there is made of stone.

Falconer on Bath Waters, page 184.

(b) Shaw's Notes to Boerhaave's Chemistry, Vol. I. page 85.

tractions it appears, that the last of these acids has a much stronger affinity with Lead, than with the earthy basis of alum. As spring waters are therefore found so frequently to be aluminous, may we not with reason suspect, that in their passage through leaden pipes, the vitriolic acid will deposite the earth with which it was combined, and dissolve some portion of the metal? And thus the fountain will become impregnated with a metallic salt, of the most poisonous and deleterious quality. It is a common observation that hard water renders pewter black; and this in all probability arises from a solution

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of the Lead and tin, of which this mixed metal is generally composed. But as a point of so much importance to the health of mankind ought to rest on better evidence than theoretical reasoning, the following experiment was made in order to determine whether water impregnated with alum be capable of dissolving Lead.

EXPERIMENT II.

Two clean and bright bits of Lead, weighing 327 grains, were immersed sixteen days in a phial of water, in which a drachm of alum had

had been previously dissolved. The volatile tincture of sulphur produced no blackness in this water, until a few drops of the solution of *saccharum saturni* were added to it; and then a dusky colour immediately succeeded. The bits of Lead carefully wiped and dried, were not found to have suffered any sensible loss of weight.

THE same experiment was repeated with hard aluminous pump water. I conceived that the Lead had communicated somewhat of a sweetish taste to the water; but when a few drops of the volatile tincture of sul-

56 ON THE POISON

phur were instilled into it, it did not exhibit any appearance of a saturnine impregnation; nor had the bits of Lead lost any part of their weight.

THOUGH the result of this experiment seems to contradict what has been before advanced, yet it does not afford me full conviction that Lead is totally insoluble in aluminous waters. For the volatile tincture of sulphur may not perhaps in every instance, be a certain test of the presence of this poisonous mineral; as I have proved that green vitriol is not of the astringency of
vege-

vegetables. (*a*) Besides, a portion of Lead too inconsiderable to be detected by any chemical examination, may possibly in irritable habits, and under certain delicate circumstances, prove highly injurious to health. (*b*) This is confirmed by the account which Dr. Tronchin has given of the colic of Amsterdam, the cause of which long eluded the searches of the learned: at last however it was discovered to arise from the use of water, slightly impregnated with Lead.

(*a*) Percival's Essays Medical and Experimental, Vol. I. 2d. Edit. page 150.

(*b*) Vide Dr. Falconer on Bath Waters, page 187.

58 ON THE POISON

Lead. But conscious of the influence of a preconceived hypothesis, I have fairly stated both the reasons and facts relating to this point, and I shall leave the decision concerning them to the more unbiaſſed judgment of the reader. (a) The uſe of leaden pumps however may be pernicious, though the conveyance of water through pipes of this metal ſhould not be eſteemed ſo: for by the

(a) Vide Percival's Eſſays Medical and Experimental, Vol. I. 2d. Edit. page 304.-----The following fact has been communicated to the public, ſince theſe obſervations on the ſolubility of Lead in aluminous waters were written, and affords a melancholy confirmation of the truth of them.

“AGEN-

the friction of the bucket against the sides of the pump, some portion of Lead will be rubbed off and suspended in the water. It may not be unseason-

" A GENTLEMAN of this town (Worcester) was
 " the father of a numerous offspring, having had one
 " and twenty children, of whom eight died young,
 " and thirteen survived their parents. During their
 " infancy, and indeed till they had quitted the place
 " of their usual residence, they were all remarkably
 " unhealthy; being particularly subject to disorders of
 " the stomach and bowels. The father during many
 " years was paralytic, the mother for as long a time
 " subject to colics and bilious obstructions. She di-
 " ed at last of an obstinate jaundice. This disease
 " had been several times removed by the use of Bath
 " water, but it always came on soon after her return
 " to Worcester; and at last eluded every method and
 " medicine which was tried.

" AFTER the death of the parents, the family sold
 " the

60 ON THE POISON

seasonable here to suggest a caution against the common practice of cleaning wine-bottles with leaden shot. It frequently happens, I am persuaded, through

“ the house which they had so long inhabited. The
 “ purchaser found it necessary to repair the pump.
 “ This was made of Lead, which upon examination
 “ was found to be so corroded, that several perforati-
 “ ons were observed in the cylinder, in which the
 “ bucket plays; and the cistern in the upper part was
 “ reduced to the thinness of common brown paper,
 “ and was full of holes like a sieve. The waters of this
 “ town are remarkably hard. They curdle with soap;
 “ coagulate milk; let fall a large precipitate upon
 “ the addition of an alkali, either fixed or volatile;
 “ and in dry seasons taste bitter and aluminous. They
 “ consequently contain a calcareous earth, dissolved
 “ by an acid, which appears to be of the vitriolic
 “ kind. Though such an impregnation may not make
 “ water a perfect menstruum of Lead, yet it certainly
 “ may

through inattention, that some of the shot are left behind; and when wine or beer is again poured into the bottles, this mineral poison will slowly dis-

" may make it capable of corroding that metal. The
 " foregoing account fully confirms the truth of your
 " observations; and indeed it is more than probable,
 " that the water of this pump, thus mixed with Lead,
 " did occasion the unhealthiness of the family who
 " drank of it. Since I wrote what is above, I have
 " been informed by the plumber employed by that fa-
 " mily, that he had several times repaired the pump;
 " and particularly that he had done so not more than
 " three or four years before the gentleman's death;
 " and that he then found it nearly in the same state
 " as it has been described; so that the corrosion was
 " effected in a short time. And consequently the wa-
 " ter must have been very strongly impregnated with
 " the noxious qualities of the metal."

Vide Medical Transactions, Vol. II. page 420.

dissolve, and impregnate those vinous liquors with its deleterious qualities. The sweetness which is sometimes perceived in red port wine may arise from this cause, when such an adulteration is neither designed nor suspected.

EXPERIMENT III.

THE very beautiful polish of the Burslem pottery, commonly called the Queen's ware, inclined me to suspect that Lead, which is easily vitrified with sand and kali, enters into the composition of its glazing. To deter-

determine whether my conjectures were well founded, I poured about an ounce and a half of vinegar upon a plate of this ware, that a large surface of the glazing might be exposed to the action of the vegetable acid. In twenty-four hours the vinegar had acquired a deeper colour, and assumed a dusky hue when two drops of the volatile tincture of sulphur were added to it. The same tincture instilled into fresh vinegar in the like proportion, produced a light cloudiness, which was succeeded by a white sediment; the sulphur being precipitated by the combination of the acid and alkali. From this trial, which was several

64 ON THE POISON

ral times repeated, it should seem that Lead is an ingredient in the glazing of the Queen's ware; but the proportion in which it is used, or at least the quantity dissolved by the vegetable acid, appears to be very inconsiderable. For two drops of a solution of *saccharum saturni* (which I computed to be equal only to the fiftieth part of a grain of Lead) mixed with half an ounce of vinegar, struck a darker colour with the tincture of sulphur than the same quantity of vinegar, after its action had been exerted upon the plate forty-eight hours.

THE

THE present experiment therefore furnishes no objection to the common use of this beautiful pottery; but it shews that vessels of it are improper for the preserving of acid fruits and pickles.

EXPERIMENT IV.

I WAS a witness to the following experiment when made by my friend Dr. Priestley, and have since repeated it. Several pieces of paper, daubed with white-lead paint, were put under a receiver, which was then immersed, about two inches deep, in a

H

vessel

66 ON THE POISON

vessel of water. In twenty-four hours the air was diminished more than one-fifth part in quantity, and was become in a high degree noxious. It extinguished a candle, did not effervesce with nitrous air, (a) and affected

(a) NITROUS air is obtained from all the metals and semimetals except zinc, by the nitrous acid. When one part of this air is added to two parts of common air, the mixture becomes hot, turbid, and of a red colour, and suffers a diminution of nearly one-third part of its bulk. These effects are observed to be exactly proportioned to the fitness of the air for respiration. With mephitic, inflammable, or any kind of noxious air, no chemical union is formed, nor any such changes produced by it. Hence the nitrous

fecting a mouse in such a manner, as must quickly have proved fatal, if the animal had not been immediately withdrawn. This air was rendered wholesome by agitation in water; which shews the propriety of placing vessels of water in rooms lately painted. Perhaps sprinkling water by means of a garden pot, would be still more effectual, because the sur-

H 2 face

trous air furnished a very accurate test of the comparative purity of other species of air.---Vide Dr. Priestley's Papers on various Kinds of Air, which will be published in the 62d. Vol. of the Philosoph. Transactions.

68 ON THE POISON

face is thus increased, and some degree of agitation produced.

EXPERIMENT V.

I TRIED the same experiment with what the painters term *dead white*, which is a composition of white Lead, linseed oil, and spirit of turpentine. The result differed in no other respect, but in the proportional diminution of air, which was less in the present than in the former trial. Surprised at this circumstance, I repeated the experiment several times, but the event was uniformly the same. It is probable

probable therefore that the oil of turpentine, by furnishing a cause of addition to the air, diminished the apparent destruction of it by the white lead. This paint is found to be more injurious to the nervous system than any other, which may be explained by the action of the turpentine in quickening and increasing the evaporation of the Lead.

EXPERIMENT VI.

I EXPOSED a very large surface of painters' oil to the air contained in a glass jar, immersed in water. In twenty

70 ON THE POISON

ty-four hours the air was diminished in its bulk one-fourth part, and instantly extinguished flame. Having no nitrous air in readiness, I could not employ this test. Painters' oil is prepared by boiling litharge and a small quantity of red lead in the oil extracted from linseed.

EXPERIMENT VII.

I MADE a similar experiment with common linseed oil, and found that the air was neither diminished in quantity, nor rendered noxious in its quality.

EXPE-

EXPERIMENT VIII.

I HAVE more than once felt myself disagreeably affected by the smell of an oil-case hood, and I was desirous of trying whether this might arise from any noxious quality communicated by it to the air. Several slips of fresh oil-case were therefore put into a receiver, which was then placed in water. The air in twenty-four hours extinguished the flame of a candle, and was diminished in quantity, but in what proportion I did not ascertain. Various compositions
are

72 ON THE POISON

are employed for making oil-case; but I believe they all contain Lead; and the most common one consists of *saccharum saturni*, gum copal, and other resinous substances, which are boiled in oil to the consumption of two-thirds of the original quantity. I am informed by an artist in this branch of business, that he is never employed in the above preparation, without suffering a most violent head-ach.

AND I have lately had a patient who laboured under a severe and obstinate colic, which seemed to be produced by the same poisonous effluvia. For previous to her disorder

der and during the short intervals of it, she was assiduously employed in shaping and sewing several hundred oil-case hoods; after a variety of remedies had been tried in vain, the cure of this patient was at last effected by alum, combined with spermaceti.

EXPERIMENT IX.

RED sealing wafers are made of fine flour, the whites of eggs, isinglass, and a little yeast. They should be coloured with vermilion; but as red lead is much cheaper, I believe it is more frequently used. The com-

74 ON THE POISON

common wafers certainly contain a large quantity of it, as any person may discover by setting fire to a few of them, when stuck upon the point of a pin. For the surface of the wafers will be covered with an infinite number of the particles of Lead, which running together will fall down into a spoon, or whatever is held to receive them. Wafers are pleasant to the taste, and they are often held long in the mouth, and sometimes swallowed through inadvertence: I have seen children fond of eating them. It is of importance therefore to know that the coarser or common kinds are poisonous, and that it is very

very absurd œconomy to purchase such on account of their cheapness. The polished Irish wafers seem to contain no Lead.

I HAVE some doubt whether the vapour of arsenic be so poisonous as it is commonly supposed, and if the candid reader will excuse the digression, I will lay before him my reasons for it. To solder works of silver filigree, and other delicate manufactures of that kind, a composition is used of which arsenic is the principal ingredient. The solder is melted by the flame of a lamp, directed by a blow pipe; and this operation cannot be performed

76 ON THE POISON

performed with due accuracy but in a close room. The greatest part of the arsenic is evaporated by the blast and flame, and some part also of the rest of the solder. And the workmen must constantly breathe these vapours, because there is little or no current of air to carry them into the chimney. Yet the men appear to enjoy as good health, and to live as long as other artists who pursue their business in close rooms, and use lamps. Amongst other examples of the truth of this observation, I saw one lately at the manufactory at Soho near Birmingham: a man aged upwards of fifty years, who has soldered silver filigree
more

more than five and thirty years ; and has regularly passed from eight to twelves hours daily in his occupation, and is at present fat, strong, active, chearful, and of a complexion by no means sickly. Neither he, nor his brother artists, employ any device to counteract the effects of their trade.

A N

A P P E N D I X.

APPENDIX

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THE COPY OF A LETTER FROM DR.
HAYGARTH, CONTAINING A PARTI-
CULAR ACCOUNT OF THE EFFECTS OF
GOULARD'S SATURNINE WATER
ON THE SUFFERERS BY THE EXPLOSI-
ON OF GUN-POWDER AT CHESTER,
NOVEMBER 5th. 1772.

CHESTER, *May* 3^{ist}. 1773.

I SHOULD sooner, my dear
Friend, have answered your be-
nevolent inquiries concerning the ef-
fects of Goulard's saturnine water
I upon

82 LETTER FROM

upon the patients who suffered by the explosion of gun-powder in this city on the fifth of November last, but the horrors of that tremendous scene, even at this distance of time, are so painful, that I feel a peculiar reluctance in recollecting their anguish and variety of wretchedness. Happy should I be, if this dreadful calamity could afford any useful instruction how in future to alleviate the miseries of mankind.

FROM the neighbouring coal-pits there are frequently sent to our Infirmary, patients, who, by the explosion of the inflammable vapour
they

they contain, have been burnt on their face, hands, and often a great part of their bodies which happened to be uncovered. Oil, in the usual method, had been generally applied to these burns. But the integuments were often so deeply affected, and to so large an extent, and the patients continued for many days in such exquisite pain, that their groans and lamentations were heard over the whole house. On this account a trial was made in these cases of the saturnine water, and with the most happy event; the excruciating pains were immediately relieved, and the burns soon healed. The striking

84 LETTER FROM

similarity of the cases afforded the most convincing argument that the same remedy should be used in the burns from gun-powder.

On the night of the fatal accident, 33 patients were admitted into the Infirmary; the hands and faces of all, with the arms and thighs of the women were in general, severely burnt. A considerable number of the old patients, with other assistants, were most assiduously employed in washing all the burnt and bruised parts with the saturnine water many times over that night. The next morning I examined very attentively
the

the appearance of the burns; they were very moderately inflamed, and upon their being asked, none of the patients complained of that painful burning vulgarly attributed to fire in the part, except one young man whose legs were so deeply affected, that all the integuments sloughed off, and the sores could not be healed in less than six months.

I COMPARED very attentively the state of the burns which had been thus treated, with those of 20 patients who were admitted into the Infirmary the next and following days. Though the latter in general

86 LETTER FROM

had received incomparably much slighter injuries, yet their burns appeared red, tense, and highly inflamed; and they complained of a severely painful burning in the parts affected. When the saturnine water had been plentifully applied to these burns, the pain and inflammation very soon abated.

As preparations of Lead, when taken internally, are known to produce such pernicious effects, the faculty have with reason doubted whether their external application were universally safe. On this account, I was particularly attentive
in

in watching every symptom that might possibly arise from the poison of Lead, and can assure you, that of these 53 patients, whose burns and contusions were very plentifully and frequently washed with the saturnine water, not one had the slightest symptom of colic or palsy during the whole time of their recovery, though so many nerves were exposed to the immediate contact of Lead.

THE only cases that proved fatal were three young girls, who were seized with the locked jaw, and died convulsed. Though this disease has

I 4 never

88 LETTER FROM

never that I know been attributed to the poison of Lead, yet as this is a purely nervous affection, I will mention such particulars of each case as will entirely remove all suspicion of this cause, by shewing that the injuries they received were fully adequate to such an effect. The poor girl, who was first seized with a locked jaw, had been so much hurt by the explosion, as to be unable to speak for twenty hours after the accident; and besides many severe contusions and burns, the *tendons* on the back of her hand were all laid bare by a deep burn. The second, besides large burns
on

on her face, arms, and thighs, with a bad contusion on her head, had the *tendons* of her ham severely lacerated, and burned. This patient complained to me particularly that a pain alternated between this wound, and the muscles of her neck and jaw that were spasmodically affected. The third had a broken arm, large burns and contusions, but was not seized with a locked jaw till the integuments on her *sacrum* were deeply mortified.

It is of importance to observe on the whole, that of 106 persons who were blown up by 800^{lb}. of gun-

90 LETTER FROM

gun-powder, 23 died almost instantly by the explosion; that among so large a number of the remainder as 83, who had received such severe burns, contusions, fractures, and dislocations, so small a proportion as three only terminated fatally: 53 who of this number had received the worst injuries, were admitted into the Infirmary. This very uncommon success I would chiefly attribute to a plentiful application of the saturnine water, together with copious evacuations, acid and acescent drinks, and supplying the wards both day and night so freely with fresh air
as

DR. HAYGARTH. 91

as entirely to clear away all the
putrid effluvia produced by so great
a number of very large sores.

I AM ever,

DEAR SIR,

With the sincerest Regard,

Your most faithful,

and affectionate,

J. HAYGARTH.

92 LETTER FROM

THE COPY OF A LETTER FROM
DR. ROTHERAM, OF NEWCASTLE
UPON TYNE.

S I R,

I AM much obliged to you for the specimen of your Experiments and Observations upon the Poison of Lead. The subject is truly interesting; and I am very glad that you have taken it in hand, as I am sure the public will reap both
pleasure

pleasure and benefit from your inquiries.

WHILST I practised at Hexham, I was frequently consulted for the work-men in the Lead mines, Smelting mills, and Refineries, of which there are many in that neighbourhood ; and I now most sincerely repent my negligence in not taking proper minutes of those cases ; had I done that, I might have now been able to have sent you an hundred of them ; but alas ! I have nothing but my memory to trust to, and therefore must speak chiefly in generals.

I HAVE

94 LETTER FROM

I HAVE ever looked upon Lead to be highly poisonous, when its particles are so minutely divided by heat, corrosion, solution, &c. as to enter the pores or absorbents of any part of the body, but more particularly those of the lungs and stomach; though I have sometimes suspected them to reach the brain itself; for as these very minute parts are rendered extremely volatile, especially by a strong heat, it is no wonder that they pervade some of the smallest pores, and penetrate into the inmost recesses.

THE

THE people who work in the mines here are generally pretty healthy; and I believe your observation with regard to this point will commonly hold, their disorders may mostly arise from the small broken pieces, dust, or washings: but I dare not assert this as an universal maxim, because I have some reason to believe that noxious effluvia are sometimes mixed with the air in old workings, and where they have not a proper number of air-shafts; and the people affected by this kind of foul air, shew very different symptoms from those who work in our coal mines. Asthmas, and those very

96 LETTER FROM

very obstinate ones, are a frequent consequence, and I believe almost universally attended with a blue expectoration, which lasts for several months, often attended with a *constipatio alvi*, and sometimes with spasmodic contractions of the muscles. I think I remember some of them paralytic; but, as I lamented before, for want of proper minutes I dare not be positive.

YOUR observation of the cupolas is a very just one, and confirmed by plentiful experience in this neighbourhood; which leads me to make some remarks on the three branches
of

of smelting, refining, and reducing ; though they may not be new to you, yet as I have had frequent opportunities of attending to them, I shall trouble you with a few hints in each.

THE effluvia rising from all these works are soon condensed and concreted when they come into the cool air, and form a great deal of white substance, which lines the chimney or flues, and what rises out falls perceptibly on the ground, sometimes in small dust, at other times in little flakes, destroying a great part of the herbage ; what remains gives the cattle the belland, and neither dogs,

K

cats,

98 LETTER FROM

cats, nor poultry will thrive near any of these mills. The smelting business has generally been reckoned less noxious than the refining, and the reducing or running the litharge into lead the worst of all; for they used always to reduce the litharge upon hearths, and indeed they still pursue this senseless method in some of our works; but the more provident ones have erected proper furnaces for this process, which convey the smoak to a greater distance; whilst the refiner stands at the mouth of the test constantly supplying it with lead, regulating the fire and taking away the litharge, whilst the bellows

bellows behind which are constantly skimming off the litharge, blow the effluvia full in his face. The quantity of these effluvia may be in some measure computed from the loss of lead in refining, which generally amounts to at least one ton in thirteen, though I am apt to believe that more of this evaporates in the reducing than in the refining; for the litharge like minium always exceeds the weight of the lead from which it is produced; whereas probably twelve tons of litharge when it is run down will scarce produce eleven of lead. To illustrate this a little farther, I took, the other day, five

K 2

grains

100 LETTER FROM

grains of litharge, and the like quantity of lead, and laid them upon separate pieces of charcoal which I held in my hand, and threw the flame of a lamp very strong upon them with a blow pipe. The litharge in a very few seconds run down into a clear piece of lead which weighed four grains and a half, the half grain evaporating almost instantly, and the vapour covered the charcoal for about an inch round, where it lay with a thin yellow or rather greenish crust. The lead was near half an hour in evaporating, but threw off the same kind of vapour; I observe from this that the litharge is much more volatile

tile than lead, and the first fumes are probably more subtile and easier raised.

THE work-men in this country call the disorder by the name of the Mill-reck, and in general it answers to the short description you have given of it in Derbyshire. The most particular case which I remember was that of Thomas Wallace, a refiner, and who had formerly wrought in the mines; he consulted me about sixteen years ago; he had then violent pains and gripings, with costiveness and a numbness in his limbs. The medicine with which he was

K 3 chiefly

102 LETTER FROM

chiefly relieved was the gum pill with a third part of aloes taken morning and evening. He went to work again, when his disorder soon returned, and brought a *gutta serena* upon one eye, and rather hurt the sight of the other; his left hand, if I remember a right, turned paralytic; which complaints baffled every effort which I made for his relief by purgatives, blisters, and nervous medicines. He then went recommended to the Bath Hospital; but, after using the waters, and such medicines as the Physicians there prescribed for some time, he returned in the same paralytic state. I heard of him
about

about two years ago, and I do not know but he may be yet living, and in the same condition, but as he is forty miles from hence, I have not frequent opportunities.

I KNOW not whether the following experiment may lead to any conclusion in your way, but you may perhaps not be displeased with a trial, which you may easily make at your leisure. Some time ago I made several unsuccessful attempts to corrode or dissolve lead in the vitriolic acid: I knew full well that infusing, boiling, or digesting would not do it, but I digested ground litharge

K 4

for

104 LETTER FROM

for some time in oil of vitriol still without effect. At last an ingenious acquaintance, to whom I had communicated my thoughts, moistened some powdered litharge with distilled vinegar, and a day or two afterwards poured some water and oil of vitriol upon it, which instantly turned the whole mass into the most beautiful white lead I ever saw; the vinegar doubtless acting as a medium of attraction betwixt the litharge and the vitriol. But the acid vitriol separates the parts of the lead too far, so that the substance, though it exceeds the best white lead of the shops in colour, is greatly deficient in specific

cific gravity; and no art which we have yet used can remedy this fault, and here I am afraid it must rest. For after several trials, it wants body to be of any use in painting; nor does it flux or vitrify easily enough to be of use in glazing the white earthen ware. But may not the minerals in some waters meet with some proportion of a similar medium, by which they may attract particles from leaden pipes, cisterns, &c. and thus carry off with them many noxious particles?

I HAVE long thought, and am lately more certain, that not only
the

106 LETTER FROM

the generality of lead ores in this country, but often the lead itself is more heterogeneous, than has been imagined. I even doubt whether some of our lead mines may not produce every known metal. Silver is well known to be contained in them all, though in widely different proportions; Mr. Cox, if I am not much misinformed, has lately produced a great quantity of copper from the flags or refuse of some of our smelting mills, and for this purpose has purchased large quantities; zinc we are sure is in some parts of the ore, and zaffre I have produced
from

from other specimens, though I have not yet brought this last to such a certainty as I could wish. The copper sometimes unites with the lead in smelting, and greatly injures it for the market, as it renders it harder and more brittle.

I MUST trouble you a little farther with expressing my doubts about your last paragraph. How far the fluxes used in soldering the filigree may fix the parts of the arsenic, or from what other cause those workmen might escape, I dare not say; but I should notwithstanding strongly

ly suspect the fumes of this very volatile and caustic mineral to be very prejudicial. Hildanus gives us several instances of bad effects from its external application in small quantities. Hoffman, in his *Metallurgia Morbifera*, Sect. xvii. says, "*Tristis casus memini, qui Lipsiæ contigit, dum in domo Stannarii, qui arsenicum cum cupro admisceret, ab haustis ejus venenatis fumis, plures in eadem domo habitantes, maligno morbo adfecti et mortui sunt.*" Hoffman likewise tells us in the same section, that the men employed in both digging and manufacturing

nufacturing the cobalt at Kuttenberg in Bohemia, are affected with vomitings, syncoptic anxieties, cardialgias, difficulties of breathing, suffocations, tremors, &c. that they appear like living skeletons.

I FEAR I have too long trespassed upon your patience, and I doubt to little purpose; as you will have so much better and more pertinent information. I most heartily wish you all the success which you can desire; I hope you will command a great deal, but am sure you will merit more.

I AM,

110 LETTER FROM

I AM, with thanks for the honour
of your last correspondence,

Your much obliged,

and very humble Servant,

NEWCASTLE,
July 8th. 1773.

J. ROTHERAM.

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DR. CARTE TO DR. GREW. III

A LETTER FROM DR. JOHN CARTE
TO DR. GREW, CONCERNING THE
BELLAND, CAUSED BY THE FUMES
OF LEAD; EXTRACTED FROM DR.
HOOKE'S PHILOSOPHICAL EXPERI-
MENTS, PUBLISHED BY MR. DERHAM,
F. R. S.

MANCHESTER, *October* 27th. 1678.

I THOUGHT it might be
worth while to give you a
short account of a distemper in
Derbyshire, very common among
those,

112 LETTER FROM

those, who are employed in the smelting-mills, *i. e.* the houses where they melt the lead down from the ore; it is by the country people called the *belland*, but for what reason I cannot learn; it is hard to give a concise definition of it, because it seldom appears but under the disguise of another disease.

THIS *belland* frequently imitates the *tormina ventris scorbutica*, but in a most exquisite manner, which is usually accompanied with extreme costiveness, and a continued suppression of urine: sometimes appears like an *asthma convulsivum*, sometimes

DR. CARTE TO DR. GREW. 113

times a continued and obstinate *dyspnoea*, and often seizes the *genus nervosum*, either in a paralytick resolution of the parts, or in spasms.

It has a different effect upon men, according to their age; if they come not to the work of the mills, till they are full grown, or of a middle age, they suffer mostly the aforementioned pains of the belly, or difficult breathing. But if taken in while young, and growing, they are subject to the palsy; their limbs (especially their fingers) being often irrecoverably resolved: or sometimes have their fingers so contracted, as to render them

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(perhaps

114 LETTER FROM

(perhaps for ever) incapable of working. Both which I have seen.

I COULD not be informed of any specifics, they had for this disease ; but that a decoction of *coloquintida*, in ale, was very common among them. I remember once an old man complained to me of the *belland*, it oppressed him in the nature of an *asthma* ; I advised him to sulphurate medicines, which did relieve him. The contraction of the fingers I have known cured, by often putting the arms into hot grains after brewing.

I HAVE not observed, whether any
of

DR. CARTE TO DR. GREW. 115

of those, that are paralytick by the *belland*, die heftick, as Dr. *Pope* relates of them, at the *mercurial* mines in *Firmly*, but it seems not improbable that they may.

THIS distemper is not only incident to men, but other creatures, as horses, cows, dogs, cats, hens, geese, &c. but, especially, cats are subject to it: indeed few creatures, that are young, will live near these mills without the *belland*.

Dogs do in their fits howl and tumble up and down, foaming like

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epilep-

116 LETTER FROM

epilepticks; this the people impute to the pain of their bellies.

I KNOW a small rivulet, on which some of these mills stand, wherein trouts have been caught, which have been supposed affected with the *bel-land*, by the irregularity of their growth, their heads being great and misshapen, their backs crooked, their tails very small, which I am apt to think might proceed from their feeding on the *smitham* or *dust* that is washed down at a flood: for not only the fumes, but also the washings of lead ore, and the *waste* (as they call it) *i. e.* the dust that remains, after the

the ore is melted, is very noxious to most sorts of creatures, and for this reason, they that live near the mills, dare not water their horses at the river, upon a flood.

THESE poisonous fumes are not only hurtful to animals, but also injurious to vegetables; for if the smoak be driven much upon any one place, it destroys all the grafs of it.

Now that the *belland* in men, or other creatures, proceeds mostly from the smoak, will be easily granted; but what these fumes is impregnated with, is the question: some fancy

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them to be antimonial, but then, methinks, they should have the same effect with the flowers of that mineral, and I never heard that any of them were inclined to vomit. I am much more apt to think, that the *mercury* in the ore is the cause, both because they that work in the *mercurial* mines, are subject to the like symptoms, especially the palsy; and also I am told, that this *belland* often begins with a swelling of the glands about the throat, which, perhaps, if not prevented, might terminate in salivation. But why *mercury* should operate so variously upon bodies, differing in age, is a question will hardly

ly

ly be solved, till it appear more plainly, whether it be nearer a-kin to alcalies or acids: its effect is easily foretold in bodies that abound with acids, whether scorbutick or venereal; but in younger persons whose humours are more insipid, and their blood freer from both fix'd salts and acids, it may, perhaps, fix itself upon the nerves, as the coolest parts, and impede the motion of the spirits; but I had rather hear others reasons about the cause of these things, than trouble you with my own.

SOME other things I have been informed of by the work-men, as that

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a little

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a little spar mix'd with the lead ore, promotes its fusion, I suppose, as the yellow marchasite, that's found with silver, makes that metal flow the sooner: that if there be any holly-wood in the fire, it hinders the fluxing of the ore, which is certainly caused by the glutinous sap of that wood.

THAT the smoak is observed to follow the water very much: I suppose the coldness of the water does condense the fumes, as is seen in reviving *mercury* from *cinnabar*. A blue film is observed on the surface of those waters, where the smoak falls.

THAT

DR. CARTE TO DR. GREW. 121

THAT a man may by wetting his finger in his mouth, or common water, draw it through melted lead or iron, without any prejudice.

Sir, THESE observations will seem barren, yet as good as I could make among these people of the *Peak*, few of which can give a rational account of either what they do, or suffer, in such matters.

I am,

Sir,

Yours, &c.

P O S T S C R I P T.

SINCE the preceding sheets were printed, I have been informed, by my ingenious friend Dr. Falconer, that two very modern books of COOKERY contain receipts for recovering WINE when sour, and preventing it from becoming so by means of cerusse, and of melted lead. I have myself seen one of these books, and have transcribed the receipt, which is as follows.

“To hinder wine from turning.”

“Put a pound of melted lead, in fair
“water, into your cask pretty warm,
“and stop it close.”

The Universal Cook, p. 244.

THIS

POSTSCRIPT. 123

THIS work was published in 1773, and is written by John Townshend, late master of the greyhound tavern, and cook to his Grace the Duke of Manchester.

It must be supposed that Mr. Townshend is ignorant of the poisonous quality of lead; but he is certainly deserving of censure for presuming to give receipts without better information. And if he, or his brethren vintners have practised the method which he recommends, they are justly chargeable with all the mischiefs such detestable arts must produce. The adulteration of wine is
indeed

indeed an evil so general, and so dangerous in its consequences, that it is to be hoped the legislature will interpose to prevent it.

It has been observed (page 74) that the common red *sealing wafers* contain Lead, and are of a poisonous quality. A Lady in Cheshire had a favourite Bulfinch, which was so tame as to be permitted to fly about the room; a liberty that seemed to improve both his health and plumage. The bird unfortunately picked up some scraps of wafers, which had been left after sealing a letter. He soon lost his appetite and spirits,
and

POSTSCRIPT. 125

and in a few days pined away and died. Another Bulfinch was procured, and when sufficiently tame, allowed the liberty which the former had enjoyed; but great care was taken to keep wafers out of his reach. However, by the inadvertence of a stranger in the family, who had been using them, a piece of one was left upon the table, which the bird immediately seized, and like the former sickened and died in consequence of it. Dr. Falconer, to whom I am indebted for these facts, adds, that some time afterwards, a third Bulfinch, belonging to the same Lady, met with a similar fate.

DR.

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DR. WALL, to whose friendship I am under many obligations, has lately favoured me with the following case.

“ I was some years ago called to the son of a Plumber in this town, (Worcester) a child about two years of age, who had been remarkably healthy till this illness. He had been taken, a few days before I saw him, with violent pains in the bowels, attended with a fever, and convulsive motions in the limbs. These complaints had been attributed to worms, and several medicines had been given unsuccessfully. When I visited him first, I found him paralytic on one side, and delirious. Upon enquiring
into

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into the cause of his disorder, and particularly whether the child had been used to go into the room where they melted the Lead, I was informed that he did frequently, and that it was a custom with his maid to let him run barefooted along the sheets of Lead, whilst they were warm, with which he appeared to be much delighted. I did not then hesitate to attribute his present disorder to this cause."

THE END.

E R R A T A.

Page 16, Line 2, *dele* fwelling.

12, 9, *dele* the.

57, 10, *for* searches *r.* reseaches.

73, 4, *change the* semicolon *into*
a full stop, and read After *for* after.

104, 12, *for* acid vitriol *r.* acid of
vitriol.